



# COALBED METHANE DEVELOPMENT: Boon or Bane for Rural Residents?

**Natural gas, or methane, is a cleaner burning fossil fuel, the demand for which is on the upswing in the United States. But there are negative impacts from the extraction, production and distribution of natural gas, especially in rural areas. This fact sheet examines the impacts of one form of natural gas development, commonly called *coalbed methane*.**

## WHAT IS COALBED METHANE?

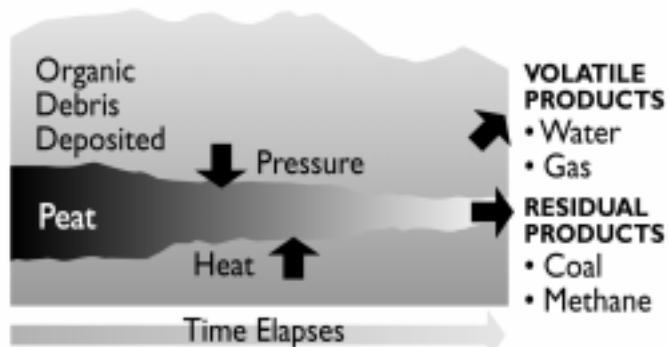
Coal is the most abundant nonrenewable energy source in the world. Coal beds are a major source of natural gas or methane. Methane is odorless, colorless and very flammable. Methane build-up in coal mines has caused many mine explosions, killing thousands of miners worldwide. Natural gas is also found in and extracted from a variety of other geologic formations.

Methane, along with water, nitrogen, and carbon dioxide, is formed when buried plant material is converted into coal by heat and chemical processes over geologic time. This process is called

“coalification” (see chart below). The amount of methane in a coal bed depends on the quality and depth of the coal deposit. In general, the higher the energy value of the coal and the deeper the coal bed beneath the surface — resulting in more pressure from overlying rock formations — the more methane the deposit holds. Coal stores six to seven times more gas than the equivalent rock volume of a conventional gas reservoir.

Total natural gas consumption in the United States grew from 18.5 trillion cubic feet (Tcf) in 1988 to 22.71 Tcf in 2000, a 23 percent increase. Coalbed methane production is currently about 1.379 Tcf, which roughly equals six percent of total U. S. consumption. That is up thirty-four times from 1988, when production was 0.04 Tcf. This explosion in coalbed methane production is largely feeding the increased demand for natural gas.

### Key Steps in Coalification Process

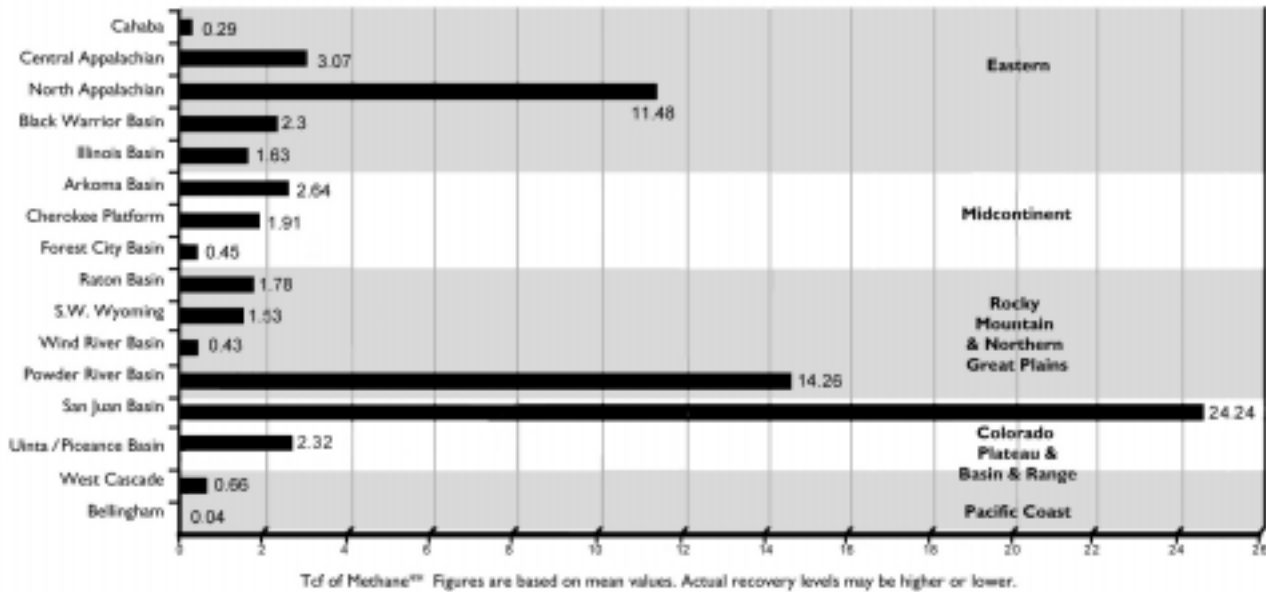


WORC graphic. Source: *Oil and Gas Journal*, October 9, 1989.

## WHERE IS COALBED METHANE FOUND?

Coalbed methane is located wherever coal is found. The San Juan Basin in southwest Colorado is the United States’ premier coalbed methane field in terms of daily production volumes, but it is also at or near its maximum production. The Powder River Basin in

## Technically Recoverable Coalbed Methane



Wyoming and Montana are becoming major players in coalbed methane development, as are the Raton Basin in northern New Mexico and the Uinta Basin in Utah. In addition to the United States, other countries that have significant coal — and thus coalbed methane — reserves are South Africa, China, Poland and the Czech Republic.

Estimates of coalbed methane resources are as much as 700 Tcf in the United States and 7,500 Tcf worldwide, but the credibility and value of these numbers are the subject of increased debate because only a small percentage of these resources can be recovered with current technology, and a still smaller percentage can be recovered profitably.

In 1995, the U.S. Geological Survey (USGS) completed an assessment of oil and gas resources in the U.S. and estimated that 49.91 Tcf of coalbed methane is technically recoverable in the lower 48 states (see table above). Coalbed methane is also found in Alaska.

There have been several other oil and gas resource assessments conducted since the USGS survey in 1995; all are based on estimates of the “technically recoverable” resource. In practice, the definition of the term “technically recoverable” is unclear and is inconsistently applied among the different assessments. Exploration, production, infrastructure and transportation costs are not factored into the resource assessments, nor are environmental impacts. In other

words, current resource assessments are overly optimistic and do not address the full implications of oil and gas development.

## HOW IS COALBED METHANE DEVELOPED?

Methane locked in coal beds is usually not as expensive to develop as natural gas found in other geologic formations because modified water well drilling rigs can be used in place of specialized oil and gas drilling rigs. Wells are cased with pipe and cemented. Cased wells tend to deter, though not always prevent, gas from seeping into nearby rock beds and underground water formations called aquifers.

Fractures that run through coal beds are usually filled with water. The deeper the coal bed, the less water is present, but the more saline (or salty) it becomes. Water pressure holds methane in the coal bed. To release the gas, its partial pressure must be reduced by removing water from the coal beds. Once the pressure is lowered, the gas and water move through the coal bed and up the wells.

At first, coalbed methane wells produce mostly water, but over time, the amount of water declines and gas production rises as the bed is dewatered. Water removal may continue for several years. The water is usually discharged on the surface or injected into aquifers.

Drill rigs are brought to well sites by trucks, and access roads must be constructed. Electric or gas powered motors are used to power the pumps and compressor stations. Pipelines are also built to gather the gas from each well and transport it to customers in distant markets.

## WHAT ARE THE PROBLEMS WITH COALBED METHANE DEVELOPMENT?

Coalbed methane development is accompanied by a number of environmental problems and human health hazards.

### 1. Disposal of water removed from coalbed methane wells

What to do with the large quantities of water removed from coalbed methane wells is a serious problem. Water is often discharged on the surface either in surface impoundments or into rivers and streams if the discharged water is relatively fresh. This practice is common in the Powder River Basin of Wyoming, though not without problems. Though drinkable, methane water in the Powder River Basin is generally unsuitable for irrigation because of high concentrations of dissolved salts and other solids. Water discharges may flood the property of landowners, causing erosion and damaging soils and plants. In Wyoming and Montana, discharges are permitted directly into streams and rivers without proper testing, posing dangers to fish, aquatic life and downstream irrigators.

Coalbed methane water in Montana has an average sodium adsorption ratio of 47, over 30 times the level that can damage soils, causing crop yields to decline. In southeast Montana, citizens' and irrigator groups are asking the state to limit the amount of salts allowed in rivers and establish a numeric limit. Methane water in Wyoming's portion of the Powder River Basin tends to be of higher quality than in Montana, though it is still unsuitable for irrigation. Most of the rivers into which coalbed methane water is discharged in Wyoming flow north into Montana. The combined effects of discharges from Montana and Wyoming on downstream irrigators, as well as fish and

aquatic life, are unknown. Conservation groups in Montana want to see the industry recharge the aquifers they deplete by re-injecting the discharged water.

In the San Juan Basin, water removed from coalbed methane wells is often injected into rock below the coal beds. The effects of injecting this water underground are little understood. In the past, state and federal agencies have paid little attention to this disposal method. Recently, however, the federal Environmental Protection Agency has begun to regulate injection wells under the Safe Drinking Water Act.

Another option for disposal of water removed from coalbed methane wells is to store it in impoundments that are usually unlined. This solution is problematic for several reasons. The impoundments do not contain water effectively, and salt-water leaks are common. The water also evaporates from these pits, wasting water that could be used to recharge aquifers. The water from these pits also ends up in rivers and streams, and increases the salts in these bodies of water.

### 2. Drinking water levels drop

In the Powder River and San Juan Basins, the level of some drinking water wells near coalbed methane development has dropped as water has been removed from coal beds. Artesian wells that tap into coal beds have also disappeared. Some families have had to drill deeper water wells to maintain a steady supply of water. Monitoring wells maintained by the federal Bureau of Land Management (BLM) in the Powder River Basin have indicated a drop in the aquifer of over 200 feet.

### 3. Contamination of aquifers

Contamination of aquifers (or groundwater) from coalbed methane development represents another environmental problem. Such contamination is a problem in the San Juan Basin, where development of natural gas from sandstone reservoirs began in the 1950s, followed more recently by development of coalbed methane in the mid-1980s. Studies by scientists indicate that there are multiple sources of contamination — some from natural causes, some from older, deteriorating gas wells completed in sandstone reservoirs, and some from recently completed

## Basins Containing Coalbed Methane Deposits

Rand Report, Assessing Gas and Oil Resources in the Intermountain West, 2002



coalbed methane wells. There is some evidence that natural gas can migrate up through vertical fissures and contaminate overlying aquifers.

### 4. Venting and seeping of methane and other chemicals

In the San Juan Basin, methane gas is seeping up in fields, forests and rivers. Methane seeps often have companion “dead zones,” where methane-saturated soils have starved the roots of vegetation, killing some trees nearly 100 years old. High levels of methane asphyxiate rodents in burrows near seeps. While such seeps are not new, they appear to be more frequent and severe since the advent of coalbed methane development. Some scientists and residents believe that coalbed methane development is aggravating the problem.

Methane seeping into drinking water wells and under people’s homes has caused a health hazard. On the Pine River near Bayfield, Colorado, Amoco bought out and relocated several families because of high levels of methane present in their basements and drinking water.

Other chemicals may vent following coalbed methane development, including carbon dioxide and hydrogen sulfide. In an area south of Durango, Colorado, the Animas River is posted to warn people about potentially dangerous hydrogen sulfide gas releases.

### 5. Underground fires

Underground fires plague coal-rich areas across the United States. They often strike where extensive mining has occurred, because shafts and tunnels help circulate the oxygen needed for coal to burn below the earth’s surface. Coalbed methane development can exacerbate this problem when water is removed

to release the gas and oxygen gets in. Two underground coal fires are burning on the Southern Ute Reservation in southwest Colorado in an area where coalbed methane has been extracted. In June 2002, an underground coal fire in Glenwood Springs, Colorado sparked a month-long wildfire in the area that destroyed people’s homes and property.

### 6. Air pollution

Gas companies argue that methane is a clean burning fuel — the use of which should be encouraged to help clean the nation’s air, especially in urban areas and for electric generation. However, large amounts of carbon dioxide — a cause of global warming — occur naturally with coalbed methane. Many producers vent this gas directly into the atmosphere. In addition, gas powered compressor stations contribute their share of air pollution (including chemicals like formaldehyde), as do the fleet of motor vehicles needed to maintain a widely dispersed extraction, production and distribution system. Finally, a long list of hazardous, or potentially hazardous substances are utilized or produced during the coalbed methane development process, which can pollute air and water.

### 7. Destruction of land and harm to wildlife

Another impact of coalbed methane development is the destruction of land. Wells are drilled, often on a grid pattern, every 80 to 160 acres. Sometimes the spacing is even smaller — areas of Garfield County, Colorado have only 20 acres between their wells. The wells are then connected with pipelines, compressor stations and roads, leaving scars on the land that will last for decades. Wildlife habitat is fragmented, and migration corridors are disrupted. High road densities and the constant vehicular traffic needed to monitor and maintain wells and pipelines are especially disruptive to wildlife.

## 8. Impacts on landowners

Some landowners receive royalties for the gas under their property, but many own only the surface and not the minerals underneath. Those who do own the minerals have the right to come onto surface owners' lands, drill wells, build roads, and otherwise develop the gas. In residential neighborhoods located near coalbed methane development, people face noisy drilling and compressor station operations and heavy truck traffic. Farmers and ranchers have had fences cut by coalbed methane operators, and roads and drill pads provide an avenue for the introduction and spread of noxious weeds. Subsurface mineral owners must treat surface owners reasonably under the law, but in reality this often leaves surface owners with little protection.

## WHY IS COALBED METHANE BEING DEVELOPED?

Prior to 1980, coalbed methane was considered to be more of a nuisance than a resource. In 1980, Congress passed a law, which provided tax credits to producers of non-conventional fuels, such as coalbed methane. This provision was aimed at increasing the nation's energy security. The credit, which ranged from 40 cents to one dollar per thousand cubic feet of gas, produced a flurry of coalbed methane development in the mid-1980s and early 1990s. The tax credit is available for coalbed methane produced from wells drilled after December 31, 1979 and before January 1, 1993, and may be claimed through the end of 2002.

Whether or not coalbed methane can be competitive without this subsidy appears to vary from region to region. For example, coalbed methane development in the Black Warrior Basin in Alabama declined after the tax credit expired, but it's on the upswing in the Powder River Basin in Wyoming.

Natural gas demand is projected to grow, especially in the electric generating sector. The North American Electric Reliability Council projects that natural gas will furnish 62,900 megawatts, or 69 percent, of net electric generation additions through 2007. It's faster, easier and cheaper to respond to increases in demand by building high-efficiency, natural gas-fired power plants than by building coal-fired power plants.

Utilities can build smaller gas-fired plants in about three years, whereas it can take 10 years to build a coal-fired plant. Gas turbine technology has advanced rapidly in the last decade, making natural gas a more efficient fuel to burn.

If demand for natural gas increases, so will prices, which is likely to spur more development. Companies will drill coalbed methane wells if they can make money based on the prevailing price of natural gas.

"A \$40,000 to \$50,000 investment to drill a coalbed methane gas well could yield a gross return of more than \$500,000 over the life of the well," said Jack Overstreet, a Gillette, Wyoming mineral lease broker. "We're talking about a 30-40% return. That's better than the stock market."

## WHAT LAWS AND REGULATIONS GOVERN COALBED METHANE DEVELOPMENT?

If you own property in areas of existing or proposed coalbed methane development, chances are you could face serious impacts to your land, livelihood and health. No existing state or federal environmental laws set direct standards for coalbed methane development. In fact, the oil and gas industry has used its muscle to win exemptions from laws that apply to nearly every other industry.

### I. Split estates



In the West, it's common for the mineral and surface rights to the same parcel of land to be held by different parties (known as a "split estate"). The mineral estate is generally considered dominant over the surface. This is a hard reality for many landowners to accept.

Under the federal Surface Mining Control and Reclamation Act, a landowner must give consent before a company can mine federal coal deposits. No such law applies to coalbed methane development, however. If the landowner refuses to sign a surface use agreement, a coalbed methane operator can post a bond with a state or federal agency and begin development. Companies that build natural gas pipelines can condemn private property against the will of the property owner. Under current law, oil and gas companies can conduct exploration activities, drill gas wells, build roads and pipelines, and conduct many other activities without obtaining permission from landowners, or even consulting with them about the placement of roads, drill sites and other facilities.

Despite the fact that federal and state laws favor mineral rights over surface rights, surface owners are not without protection. Surface owners have some ability to ensure that mineral operators respect and protect your property and quality of life. For more information, see "Coalbed Methane: A Guide to Protecting Your Property" on [www.northernplains.org](http://www.northernplains.org)

## 2. Bonding

There are two main federal laws under which the BLM has authority to require bonding: the Stock Raising Homestead Act (SRHA) of 1916 and the Mineral Leasing Act (MLA). Under the SRHA, before entering a surface owner's property to drill the mineral operator must secure a written consent or waiver from the landowner and obtain a surface damage agreement, or post a bond to cover damages. The bond must exceed \$1,000 and is supposed to cover damage to crops, improvements, and any loss of income from using the land. Under the MLA and its implementing regulations the oil and gas lessee or her/his operator must furnish a bond for at least \$10,000 per lease to ensure compliance with all the lease terms, including protection of the environment. Hundreds of oil and gas wells can be drilled on one lease.

Companies can bypass the \$10,000 per lease requirement and post a blanket bond of \$25,000 for all the wells they drill in one state. A company that operates in more than one state can post a bond of \$150,000 regardless of the number of wells it plans to drill. Many people believe that current bonding requirements are inadequate and need to be strengthened. State bonding requirements vary. In Wyoming, the state oil and gas commission requires a \$25,000 bond per company, regardless of how many coalbed methane wells the company drills.

## 3. State and local requirements

The balance of rights between mineral operators and surface owners varies depending on whether state or federal laws apply. If the state or a private individual or company owns the minerals beneath your land, then you and the mineral lessee must follow state law, which varies from state to state.

State laws and regulations usually include requirements for landowner notification, gas well spacing, compensation for damages, bonding and reclamation. State agencies and commissions tend to focus on promoting development and regulating "down hole" impacts, and show little interest or inclination in assessing or addressing the broader impacts of coalbed methane development. Contact your state's lead oil and gas agency or commission and ask them to explain what state laws and regulations apply.

Local governments may also have some authority to regulate the impacts of coalbed methane development depending on the particular state.

For example, under Colorado's land use planning statute counties have authority to regulate land use (including coalbed



methane development) within their boundaries.

#### 4. Federal requirements

If the federal government owns the minerals under your land and leases them (depending on the Act under which the surface was transferred to private ownership), then federal laws apply in addition to state laws. In general, federal laws provide stronger protections.

The primary federal law governing coalbed methane development is the Mineral Leasing Act of 1920 (MLA), as amended by the Federal Onshore Oil and Gas Leasing Reform Act of 1987 (FOOGLRA). This statute authorizes the Secretary of Interior to issue leases to private individuals and companies to extract coalbed methane.

The primary objective of the MLA is to ensure that the federal government receives royalties for the sale of mineral resources. FOOGLRA contains important provisions designed to protect other natural resources. It requires the Bureau of Land Management (BLM) to provide the public 45 days advance notice of all oil and gas lease sales and 30 days notice prior to approval of drilling permits. FOOGLRA also requires oil and gas operators to submit an acceptable plan of operations and a reclamation bond.

The National Environmental Policy Act (NEPA) also applies to coalbed methane development whenever the federal government is about to undertake a "major federal action." The NEPA process as it applies to coalbed methane development consists of four stages: planning, leasing, full field development and permits to drill.

First, the BLM and U.S. Forest Service (USFS) must allow the public to participate in developing or amending land use plans. Usually the BLM or USFS writes an environmental impact statement along with a land use plan, and the agencies must seek your views at several points in this process.

Prior to conducting any oil and gas related activity, the individual or company must first obtain an oil and gas lease from the BLM. Public notice that lands have been



proposed for leasing must be posted 45 days prior to the sale. Your involvement is critically important at the lease sale stage. Once a lease sale is final, the operator has a contractual right that allows entry onto the land surface, subject to lease stipulations.

After obtaining a lease in a valid sale, the operator will apply to the BLM or USFS for approval to develop exploratory (or "pilot") projects, and in the case of proven reserves, for full-field development. This analysis provides yet another opportunity for public participation.

Finally, no lessee can undertake any activity that disturbs the surface of a leased parcel without an Application for Permit to Drill (APD). The APD is the fourth and final stage before drilling occurs, and provides the public with one last opportunity to offer input, voice concerns, and appeal permits that are approved in violation of the law.

As previously mentioned, when a landowner does not own the subsurface minerals, a gas company can start development without the landowner's consent, although the landowner must be treated in a "reasonable" manner.



Gas companies often seek to negotiate agreements with individual property owners, pitting neighbor against neighbor. The best route for citizens to take when faced with coalbed methane development is to communicate with their neighbors, work together and respond publicly to any intimidation tactics by the gas companies. In addition, here are some general tips:

- Ask organizations that have experience with oil and gas development issues for any assistance they can give. If you need help finding an organization, contact WORC.
- Make sure you know what permits and environmental analyses are required before drilling can occur, and get involved.
- Pressure the gas companies and government agencies to determine baseline conditions (for example, for water quantity and quality) before development of coalbed methane takes place, and conduct a cumulative impacts analysis.
- Request that a net air pollution audit be conducted for the entire development process, from extraction to production to distribution.
- Fight to put surface estate owners on equal footing with owners of the subsurface mineral estate.
- Obtain copies of model surface protection and water well mitigation agreements. If you own the subsurface minerals, don't let the gas company on your property without a signed agreement. If you don't own the subsurface minerals, try to get a reasonable agreement from the company, recognizing no such agreement is required.
- Require the gas company to identify coalbed methane well sites, as well as discharge points or injection wells, prior to any drilling.
- If you own the minerals underlying your property, negotiate a fair royalty rate with the company (12 to 20 percent is within reason).
- Monitor drilling and development activities and request frequent on-the-ground inspections.
- Join one of the organizations listed here and help us hold gas companies and government agencies accountable. Consider making a financial contribution to support our work.

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